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Measurement, geometry, decimal fractions, and percentage constitute unit content for Level II-A. No step-by-step procedures are given. Each unit has general procedural and content approach suggestions.

The unit begins with measurement because most class members will be taking a practical arts course and will need to be able to measure materials. Teachers of practical arts courses and mathematics should correlate instruction.

The purpose of Level II-B is to review the preceding three semesters' work and to make mathematics useful. Understanding of economics is emphasized through field trips and practical experiences. The four units include earning money, owning and operating a car, spending wisely, and planning, buying and maintaining a home.

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MATHEMATICS — LEVELS IIA and IIB

for

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in

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TPP MATHEMATICS - LEVEL II-A

This unit begins with a study of measurement, for two reasons: (1) Most of the members of Level II TPP classes will be taking a practical arts course for the first time and will need to be able to measure materials in these classes. (2) The study of measurement is a good way to review the previous semester's work in fractions. Stress the measuring of actual objects throughout this work.

A conference with teachers of practical arts courses is recommended at the beginning of the semester, to correlate instruction. These teachers may be able to lend the class some of the instruments they use for measuring, and provide suggestions as to which kinds of measurements should be stressed to help these students in their practical arts classes.

COURSE OUTLINE

UNIT I. Measurement

UNIT II. Geometry

UNIT III. Decimal Fractions

UNIT IV. Percentage

I. Measurement

Review the idea of a number line. Show how a ruler is actually a type of number line. Review the basic fractions, particularly halves, fourths, eighths, and sixteenths. Help the students learn how to use a ruler, and take time to do this thoroughly. Many students in a TPP class literally do not know how to measure length. This work can be used as a means for reviewing fundamental processes with whole numbers and fractions.

Progress from measurements with a ruler to measurements with a yardstick. Be sure that the students also learn how to measure by starting at some point other than the end. (A two-foot ruler from a shop may also be used.) Help the students learn the names and abbreviations for the basic units of linear measure. Review the principles of ratio. Teach the students how to convert from one unit of measure to another, and show them how to make and use conversion tables. If possible, borrow a steel tape measure from the shop, and give the students some practice in measuring large distances, both indoors and outdoors. The athletic coach may show the students how the chain is used for measurement in a football game and explain its purpose.

Following the work with linear measure, progress to measurements of weight, volume, time and temperature. Provide experience in making conversions to lesser-used measurements, so that the students will gain some skill in doing this, but stress only the most commonly used measurements. Relate this work to actual uses for measurement outside of school. Use the textbook when feasible, but also make extensive use of shop manuals and other practical arts manuals, including cookbooks, sewing guides, instructions for building models, and any other available materials. The principles of ratio should be reviewed throughout this work. Six weeks would not be too long to spend on this unit, particularly since it is to be used also as a review.

II. Geometry

A. Plane geometric figures

Discuss the experiences of the previous units work as they relate to lines and their measurement. Introduce the principles of angles and their measurement. Teach the meaning of right, acute, and obtuse angles. Develop the basic concepts of the terms parallelogram, rectangle, and square, and show the students how to construct each. Discuss the meaning of perimeter and help the students learn to find the perimeter of parallelograms, rectangles, and squares. This process will be best learned if done by diagrams until thoroughly understood, before developing a formula for arithmetic computation. Much experience should be provided in measuring objects, such as the floor of the room, or the tops of desks and tables, and calculating their perimeters.

Discuss the meaning of square measure and area. Direct each student to construct, label, and keep on hand a model of a square inch and a square foot. The first work done with square measure should be direct. Show the students how, by use of their models of a square inch and a square foot, they can find the areas of many squares and rectangles. Make sure that the class understands that a square is a special type of rectangle. Next, show the students how they can measure actual rectangles indirectly by drawing diagrams of them, and finally, help them evolve a formula for finding the area of a rectangle. Have them use the formula for finding the areas of squares and rectangles until they can find such areas with ease. Stress the drawing of diagrams for all problems at first, in order to keep the work concrete.

Show the students how to make and cut out various types of parallelograms. Experiment with the parallelogram cutouts until the class can see that by cutting and reassembling, a rectangle with the same area can be formed. The rectangle-parallelogram described in the Teacher's Manual for Arithmetic We Need, Book 7, is useful for demonstration after the class has done some experimenting on its own. Make all work as practical as possible, and use problems from many different sources. Help the students make and learn conversion tables for the more commonly used square measures.

In like manner, conduct a study of triangles. Relate the area of a triangle to that of a corresponding parallelogram. Discuss the characteristics of right triangles.

Conduct a study of circles. Help the students learn how to construct a circle. Teach them the names and the meanings of the various parts of a circle. Arithmetic We Need, Book 8, has a good lesson on finding the value of pi empirically. When the students understand fully how to find the circumference of a circle, proceed to the process for finding the area of a circle. Arithmetic We Need, Book 8, suggests an interesting way to present the area of a circle. In developing this approach with the students, have them draw a circle, plot its radius, construct a square on the radius, compute the area of this square, then multiply this area by pi to find the area of the circle. This method is somewhat more concrete than simply memorizing and using the formula. If such a diagram is drawn with each problem for several days at the beginning of this work, the pupils can better visualize and understand the method for finding the area of a circle.

As time and the abilities of the class permit, demonstrate and identify other types of plane figures and help the students learn how to compute their perimeters, but do not stress this part of the study.

B. Solid figures

In developing computations for solid figures, follow procedures similar to those suggested for working with plane figures. Construct and use models of actual cubic inches in making direct measurements of volume and helping the class to evolve formulas. Place emphasis on computations involving rectangular and square prisms and cylinders. Cones and pyramids should be studied only if the class does very well with its work on volumes.

III. Decimal Fractions

Since the class has had experience in measuring objects throughout the previous two units, only a brief review of regular fractions should be necessary before beginning the work on decimal fractions. Review the basis for the decimal numeration system, and relate decimal fractions to common fractions in tenths, hundredths, and thousandths. A useful tool for studying both decimal fractions and percents is a square divided into 100 equal parts. One of the students taking mechanical drawing could draw such a square on a duplicator master, and this could be used to run off a sufficient quantity for the class. Follow a general pattern in presenting all decimal fractions—first the physical models, then diagrams, and finally numerals. Whenever it appears that the class is working without full understanding, go back to diagrams for a review.

Help the students understand the meaning of decimal fractions and learn to read and write decimal fractions, always relating them to a diagram or to some concrete object. Teach the students how to round off decimal fractions. The use of a number line will help to demonstrate this. When the class has learned to round decimal fractions, stress the estimating of answers. Help the students learn how to add, multiply, subtract, and divide decimal fractions, and to convert common fractions to decimal fractions. Present these processes in as concrete a way as possible at first, through the use of hundred-squares and other diagrams or objects. Since the students should know how to convert common fractions to equivalent common fractions, use only this method at first, directing the students to change a common fraction to an equivalent common fraction in tenths, hundredths, or thousandths, then rewrite it as a decimal fraction. Then, using only the most commonly used fractions, help the students learn how to convert decimal fractions to common fractions.

When the class has gained some skill in the use of decimal fractions, introduce their relationship to dollars and cents.

Introduce computations with money in which both dollars and cents are used. (Previous problems in this class involving money have concerned dollars or cents, but not both. The purpose of this approach was to avoid discussion of cents as decimal fractions until the class had been introduced to decimal fractions.)

IV. Percentage

Introduce the concept of percent as a special type of decimal fraction. Use the hundred-square extensively to help the students learn the meaning of percents. Review common and decimal fractions thoroughly throughout this study of percent. Help the students learn how to convert a percent to an equivalent decimal or common fraction, also, how to find a percent of a number and how to find what percent one number is of another. Stress only the most commonly used percents. Make extensive use of newspaper and magazine advertisements, labels which list the contents of a product in percents, and similar resources.

TPP ARITHMETIC - LEVEL II-B

The arithmetic program in Level II-B has a two-fold purpose: (1) to provide a cumulative review of the work done in the preceding three semesters' work, and (2) to make the mathematics content as useful and as topical for the TPP student as possible. Included below is a general outline of the topics to be studied, but this outline should be used flexibly, according to the basic interests and abilities of the class and the types of materials available for study.

This semester's work, in particular, provides a special opportunity for the teacher to help broaden the economic understanding of the pupils. Careful emphasis should be given to the exercise of true thrift, careful buying, wise borrowing, and thoughtfully planned spending. Make use of resource people and field trips whenever possible in this unit. Local business men, bankers, credit people, housewives, and many others could talk to the students about intelligent, careful spending. A trip to a local bank would help the students to learn directly about how to handle a savings account or a checking account, or how to borrow money, and about the availability of job opportunities, and what training is necessary for such jobs. In the follow-up discussions following such a trip, do not stress how a bank operates as a business, but rather how a bank operates with respect to its customers.

A trip to a large department store would help the students to learn about different kinds of credit, the cost of credit, and how accounts are opened and handled at the store. A visit to an automobile dealer would help the students learn how cars are bought and sold, how credit is arranged, how much the credit costs, and how this cost may compare with the cost of borrowing money elsewhere. A visit to a realtor or a builder would help the students learn about the factors involved in buying or renting suitable housing. Many other such trips would also help the students to gain additional knowledge about how to approach the proper agency when involved in buying or selling.

COURSE OUTLINE

Unit I. Earning money

Unit II. Owning and operating a car

Unit III. Wise Spending

- A. Budgets and planned expenses
- B. Bank accounts and savings
- C. Interest on money saved or borrowed

Unit IV. Planning, buying, and maintaining a home

- A. Discounts and careful buying
- B. Installment buying
- C. Insurance and depreciation